

ACCESSION #: 9010090212

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Haddam Neck PAGE: 1 OF 6

DOCKET NUMBER: 05000213

TITLE: Manual Plant Trip Due To Feedwater Control Valve Failing Open

EVENT DATE: 09/03/90 LER #: 90-018-00 REPORT DATE: 10/01/90

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 080

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: C.W. Martin, Engineer TELEPHONE: (203) 267-2556

COMPONENT FAILURE DESCRIPTION:

CAUSE: B SYSTEM: SJ COMPONENT: FCV MANUFACTURER: F130

REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On September 3, 1990, at 0457 hours, with the plant in Mode 1 at 80 percent power, the main feedwater regulating valve for the No. 1 steam generator failed open. Immediate operator action consisted of manually tripping the plant, closing the main steam trip valve and isolating feedwater to the No. 1 steam generator. This event also resulted in automatic actuation of the auxiliary feedwater system. Subsequent disassembly and inspection of the valve revealed that the plug had separated from the valve stem. It was also noted that fragments of the valve stem were carried downstream in the feedwater system. An engineering evaluation determined that the loose parts were not a concern for one operating cycle. The root cause was improper part fabrication at the factory. Corrective action consisted of modifying the stem plug assemblies on all four feedwater regulating valves with a welded joint where the plug attaches to the stem. This event is

reportable under 10CFR50.73(a)(2)(iv) since it resulted in manual actuation of the Reactor Protection System and automatic actuation of an Engineered Safety Feature.

BACKGROUND INFORMATION

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The main feedwater system (EIIS Code: SJ) contains two electric main feedwater pumps (EIIS Code: P) each rated at 9600 gpm at a rated pressure of 1500 psig. The main feed pumps will trip on low suction pressure, however, they will automatically restart when the low suction pressure condition clears. Four main feedwater regulating valves (FW-FCV-1301-1 thru 4) (EIIS Code: FCV) control feedwater flow to the four steam generators. There are two trains of auxiliary feedwater (AFW) (EIIS Code: BA) each consisting of one steam-driven auxiliary feed pump designed to deliver a minimum of 450 gpm at 600 psig at the design speed of 4430 rpm. AFW flow is controlled both by air operated steam admission valves (MS-PICV-1206A & B) to the Terry Turbines and by air operated feedwater bypass valves located in each of the four main feedwater lines. The AFW system automatically actuates due to either two main feed pump circuit breakers opening or two out of four steam generator wide range levels less than 45 percent on train A or B (30 second time delay) The auto actuation feature has to be subsequently reset at the control board to allow operators to manually control AFW flow. The AFW system is an Engineered Safety Feature.

EVENT DESCRIPTION

On September 3, 1990, at 0457 hours, with the plant in Mode 1 at 80

percent power, the main feedwater regulating valve (FW-FCV-1301-1) for the No. 1 steam generator failed open. Operators took manual control of the valve, however, it had no effect and steam generator level continued to rise. Both main feed pumps cycled off and on six times due to low feed pump suction pressure resulting in automatic actuation of the auxiliary feedwater system. An auxiliary operator was dispatched to the auxiliary feed pump area and proper operation of the pumps was verified locally. Operators subsequently took manual control of AFW.

Approximately 30 seconds following the start of this event the operators manually tripped the plant. They also closed the main steam trip valve and isolated feedwater to the No. 1 steam generator thereby terminating the event. The shaft seal on the "A" main feed pump (P-31-1A) failed as a result of the transient and the pump was isolated. The "B" main feed pump (P-31-1B) was subsequently restarted.

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CAUSE OF THE EVENT

The root cause of this event was determined to be incorrect assembly or refurbishment of the plug and stem assembly at the factory. The lower portion of the stem broke causing the plug to separate from the valve stem. The sequence of events presented below is the most likely failure scenario which led to the failure of the stem-plug assembly. This sequence was developed based on metallurgical examinations and inspections of the valve body and failed assembly.

1. The threads in the plug were damaged during part fabrication at the factory. As a result, the stem-plug joint had inadequate structural integrity.
2. At some point, when the valve was shut, the plug-stem retaining pin was sheared. With damaged plug threads, the actuator would develop enough force to shear the pin. It is also possible that a short pin was installed that did not penetrate into the stem.
3. The plug was free to rotate or work its way free of the stem over a period of time. Thread marks on the stub of the pin established that plug rotation occurred.
4. On September 2, 1990, at 0930, the day prior to this event, the No. 1 feedwater regulating valve went full open while troubleshooting the feedwater flow recorder (LER 90-017-00). The plug at that time probably rotated a vertical distance of more than 3/8 inch. When the valve went fully open the valve plug may have lost contact with the guide cages of the seat rings. The plug was free to move laterally, imposing a bending moment on the stem. Fatigue cracks began to form at an existing defect in the stem.
5. The weakened stem failed due to fatigue on September 3, 1990, initiating the excess feedwater event.
6. The lower stub of the stem then worked loose from the plug and was carried downstream in the feedwater system.

SAFETY ASSESSMENT

This event is reportable under 10CFR50.73(a)(2)(iv) since it resulted in manual actuation of the Reactor Protection System and automatic actuation of the AFW system which is an Engineered Safety Feature. The excess feedwater transient is analyzed in the Updated FSAR, Chapter 15, Section 15.2.4. For this transient, at 100 percent power, with four reactor coolant loops in operation, the UFSAR Chapter 15 Non-LOCA Transient Analysis credits operator action as the means of protecting plant equipment. Since the consequences of this transient are bounded by the Chapter 15, excess feedwater analysis, the safety significance of this event is minimal. Also as a result of this event, the four loose parts listed below were believed to be released into the main feedwater system:

1. 2 1/2 inch long x 1 1/4 inch diameter fragment from broken valve stem.
2. 1 inch long x 1/4 inch diameter piece from the retaining pin used to prevent plug rotation within the stem threads.
3. Two small triangular pieces from the lower valve seat ring.

A technical evaluation of the effects of the loose parts was conducted and the following conclusions were reached:

1. The velocities and the duration of the flow transient were large enough to transport these loose parts into the No. 1 steam generator.

2. It is possible that the larger fragment from the broken valve stem is still in the main feedwater piping or trapped in the feed ring of the steam generator. The diameter of this piece is larger than the original diameter (1 inch) of the flow holes in the feed ring.
3. It is possible that the retaining pin may have been a short pin in which case all pieces of the pin were found in the failed plug. If a standard size pin had been used it may still be in the valve stem fragment.
4. The loose parts did not lodge in any valve seating surface therefore there is no concern with valve operability.
5. The preliminary results of the tube wear and impact evaluation have shown that one full cycle of operation is not sufficient time to cause steam generator tube failure. It therefore has been determined that these parts may remain in the steam generator for at least one operating cycle.

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CORRECTIVE ACTION

Short term corrective actions included the following:

1. A spare stem-plug assembly was installed in the No. 1 feed regulating valve. The assembly was modified to reduce the probability of a similar failure. A fillet weld was applied to the threaded joint where the plug is attached to the stem. A liquid penetrant examination was performed on the fillet weld.

2. The other three feedwater regulating valves were disassembled and the stem-plug assemblies were inspected for evidence of similar degradation. All three assemblies were found acceptable and received the same modification as described above.

3. Prior to installation all four stem-plug assemblies were radiographed and proper fabrication of the assemblies was verified.

4. One spare stem-plug assembly was cut up and destructively tested. The threads in the plug were not damaged and adequate pin engagement into the stem was verified. This confirmed that thread damage in the failed plug was an isolated condition and not a generic problem with the fabrication technique.

5. Attempts were made to locate the loose parts released into the main feedwater system. The check valve (FW-CV-143-1) for the main feedwater line to the No. 1 steam generator was radiographed along with the vertical elbow downstream of the check valve. It was determined that no loose parts had lodged at these locations.

Long term corrective action is as follows:

1. Evaluate the need for further inspections on existing spare parts and the need for additional quality controls during the fabrication and procurement process.
2. Evaluate the need to locate and retrieve the loose parts generated by this event during the next refueling outage.

ADDITIONAL INFORMATION

1. Failed component: Valve stem-plug assembly

Manufacturer: Fisher Controls

Valve Type: 8", reverse acting, double seated, type ARV globe control valve.

Part Number: 21B5666X032

2. Failed component: Main feed pump shaft mechanical seals

Manufacturer: Bingham - Willamette (pump)

John Crane (shaft seal)

Part Numbers: CF-SP-95918

CF-SP-30641-1

PREVIOUS SIMILAR EVENTS

1. Abnormal Occurrence Report No. 69-8, dated June 12, 1969.

2. LER 86-041-01, dated August 30, 1986.

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CONNECTICUT YANKEE ATOMIC POWER COMPANY

HADDAM NECK PLANT

RR#1 BOX 127E EAST HAMPTON, CT 06424-9341

October 1, 1990

Re: 10CFR50.73 (a)(2)(iv)

U. S. Nuclear Regulatory Commission

Document Control Desk

Washington, D. C. 20555

Reference: Facility Operating License No. DPR-61

Docket No. 50-213

Reportable Occurrence LER 50-213/90-018-00

Gentlemen:

This letter forwards the Licensee Event Report 90-018-00, required to be submitted, pursuant to the requirements of Connecticut Yankee Technical Specifications.

Very truly yours,

John P. Stetz

Station Director

JPS/dl

Attachment: LER 50-213/90-018-00

cc: Mr. Thomas T. Martin

Regional Administrator, Region I

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J. T. Shedlosky

Sr. Resident Inspector

Haddam Neck

*** END OF DOCUMENT ***ACCESSION #: 9010050252
